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PEAUS 12 MAR 2004

CLAIMS

1. An internal surface chucking mechanism (ISM) comprising a coupling mechanism (103, 105, 107) activable for gripping and for release of a workpiece (W) in process on a processing machine, the workpiece defining an external surface and an internal surface configured for access from the outside, the processing machine comprising:

an inner chamber (70) defining an axis (A) and a volume of space inside the processing machine,

an external surface chucking mechanism (EXS) releasably and retrievably retained in axial alignment in the inner chamber and configured for gripping and for releasing an external surface of the workpiece in process on the processing machine, and

a push rod (7) operatively associated with the EXS to controllably command gripping and release of the external surface of the workpiece in process, whereby retrieval of the EXS from the inner chamber and insertion therein of the IMS in replacement, provides operation of the processing machine in a first configuration with an EXS, and in a second configuration with an ISM, and *vice versa*,

the ISM further comprises a bushing (101) defining a bushing outside and a bushing inside, the bushing outside being configured to be retrievably received in axial alignment inside the inner chamber (70), and the bushing inside being configured for receiving the coupling mechanism, and

the coupling mechanism comprises a collet (107) with jaw pads (183) on collet fingers (181) normally in retracted position, and extensible radially outward to grip the workpiece, a plunger (103) with a rod head (203), and a spring (105) biasing the plunger away from the collet, and the ISM is configured for insertion and retention in the inner chamber, and for retrieval therefrom, to provide reversible exchange in replacement of the EXS, in operative association with the push rod to activate the coupling mechanism, characterized in that:

forward translation of the push rod (7) against the plunger (103) urges the rod head (203) against the collet fingers (181) for the jaw pads to grip an inner

PEAUS 12 MAR 2004

diameter of the workpiece, while biasing the spring between the plunger and the collet, and

backward translation of the push rod away from the plunger causes the spring to actively bias the plunger backward, and the jaw pads to retract radially inward, whereby the gripped workpiece is released.

2. The ISM according to Claim 1, further characterized in that the ISM is operable with a processing machine operating a process selected, alone and in combination, from the group of processes consisting of material removal, fastening, joining, surface treatment, and quality assurance.
3. The ISM according to Claim 1, further characterized in that the ISM is configured for operation both when rotative and when non-rotative.
4. The ISM according to Claim 1, further characterized in that the ISM is operable with a processing machine comprising a rotating spindle (3).
5. The ISM according to Claim 1, further characterized in that the ISM and the EXS are mutually and reversibly exchangeable *in situ*.
6. The ISM according to Claim 1, wherein the processing machine defines an initial external configuration when operating an EXS, and the ISM is further characterized in that exchange of the EXS with the ISM maintains unaltered the initial external configuration of the processing machine.

7. The internal surface chucking mechanism (ISM) according to Claim 1, wherein:

the bushing (101) is configured for retention in the processing machine inside the spindle (3), which has an outside front threaded portion (9ST) accommodated for fastening a cap-nut (5) thereon, and
the EMS is further characterized in that:

when the bushing is received in axial alignment inside the inner chamber (70), and the cap-nut is fastened to the spindle, axial relative translation between the bushing and the spindle is prevented.

15. A method for providing an internal surface chucking mechanism (ISM) comprising a coupling mechanism (103, 105, 107) activable for gripping and for release of a workpiece (W) in process on a processing machine, the workpiece defining an external surface and an internal surface configured for access from the outside,

the processing machine comprising:

an inner chamber (70) defining an axis and a volume of space inside the processing machine,

an external surface chucking mechanism (EXS) releasably and retrievably retained in axial alignment in the inner chamber and configured for gripping and for releasing the external surface of the workpiece in process on the processing machine, and

a push rod (7) operatively associated with the EXS to controllably command gripping and release of the external surface of the workpiece in process, whereby retrieval of the EXS from the inner chamber and insertion therein of the IMS in replacement, provides operation of the processing machine in a first configuration with an EXS, and in a second configuration with an ISM, and *vice versa*,

the ISM further comprises a bushing (101) defining a bushing outside and a bushing inside, the bushing outside being configured to be retrievably received in axial alignment inside the inner chamber (70), and the bushing inside being configured for receiving the coupling mechanism, and

PEAUS 12 MAR 2004

the coupling mechanism comprises a collet (107) with jaw pads (183) on collet fingers (181) normally in retracted position, and extensible radially outward to grip the workpiece, a plunger (103) with a rod head (203), and a spring (105) biasing the plunger away from the collet, and the ISM is configured for insertion and retention in the inner chamber, and for retrieval therefrom, to provide reversible exchange in replacement of the EXS, for operative association with the push rod to activate the coupling mechanism, characterized by the steps of:

translating the push rod (7) forward against the plunger (103) for urging the rod head (203) against the collet fingers for the jaw pads to grip an inner diameter of the workpiece, while biasing the spring between the plunger and the collet, and

translating the push rod backward away from the plunger, causing the spring to actively bias the plunger backward, and for the jaw pads to retract radially inward, whereby the gripped workpiece is released.

16. The method according to Claim 15, further characterized by:

operating the ISM with a processing machine running a process selected, alone and in combination, from the group of processes consisting of material removal, fastening, joining, surface treatment, and quality assurance.

17. The method according to Claim 15, further characterized by:

configuring the ISM for operation both when rotative and when non-rotative.

18. The method according to Claim 15, further characterized by:

operating the ISM with a processing machine comprising a rotating spindle
(3).

19. The method according to Claim 15, further characterized by:

replacing the ISM with the EXS in situ, in mutual and reversible exchange.

20. The method according to Claim 15, wherein

the processing machine defines an initial external configuration when operating an EXS, and

the method is further characterized by:

maintaining the initial external configuration of the processing machine unaltered after exchange of the EXS with the ISM.

21. The method according to Claim 15, wherein:

the bushing (101) is configured for retention in the processing machine inside the spindle (3), which has an outside front threaded portion (9ST) accommodated for fastening a cap-nut (5) thereon, and

further characterized in that:

when the bushing is received in axial alignment inside the inner chamber (70), and the cap-nut is fastened to the spindle, axial relative translation between the bushing and the spindle is prevented.